

these grounds of rejection and urge reconsideration in light of the following comments.

As explained previously, the presently claimed invention is directed to a grease composition which is used to lubricate bearings contained in spindle motors employed in peripheral information devices such as hard disc drives, floppy disc drive memories, compact disc drives, magneto-optical disc drive systems, etc., found in computer systems and video tape recorders. The present inventors have found that when a lubricating grease composition comprises the claimed carbonate compound(s) as a base oil and the claimed molybdenum compounds, the composition has unexpectedly superior properties with respect to overcoming the problem of generating gaseous oil or fine particles of the lubricating grease scattering from the inside of the bearing during operation thereof to contaminate the inside of the peripheral information device and cause the malfunction thereof.

The base oil of the present invention requires a carbonate compound(s) having the alkyl groups provided therein distributed concentrically in the range of from 13-15 carbon atoms in order to give the carbonate composition improved evaporation and frictional torque characteristics. The combination of the claimed carbonate compound(s) and molybdenum compound(s) results in the generation of a reduced amount of outgas during the operation of a peripheral information device which results in a greatly reduced generation of gaseous oil or fine particles of the lubricating grease being scattered inside a bearing and thereby improves the operation of the peripheral information device.

The Applicant is a bearing manufacturer that provides ball bearings of ultralow outgassing and lower frictional torque throughout the peripheral information device industry in order to meet the requirements thereof. As will be further discussed below, the presently claimed invention clearly is

patentably distinguishable over the prior art cited by the Examiner.

Co-pending application Serial No. 09/349 465 discloses grease compositions in which the specific molybdenum compounds required by the present claims are not disclosed. As already discussed above and will be further elaborated on below, the claimed combination of carbonate base oil and molybdenum compounds produces a grease composition which has unexpectedly superior properties when used in pre-assembled ball bearings contained in peripheral information devices. Therefore, the presently claimed invention is patentably distinguishable over co-pending patent application Serial No. 09/349 465.

Moreover, even if the carbonate base oil used in the present invention and the application were the same as each other or further, an additive thereto as well known, the present invention still will be unobvious in that the grease composition of the present invention has superior properties associated therewith. A person of ordinary skill in the art recognizes that a bearing grease for information devices should not be compounded with any additives, if possible, or if additives are added, they should be added in as small amount as possible so as to stabilize the properties of the bearings over a long period of time. This is different from the general knowledge of greases used in other fields and, therefore, given the different requirements for lubricating ball bearings in information devices, general knowledge regarding lubricating greases cannot be applied thereto.

As pointed out previously, the Morway et al reference discloses synthetic lubricants which comprise organic carbonates having hydrocarbon radicals with at least eight carbon atoms. This reference has no disclosure with regard that any advantage would be associated with the claimed requirement that the alkyl residues in the carbonate compound have from 13-15 carbon atoms. The low viscosity carbonates of Morway et al having alkyl residues with a low carbon number

would scatter onto a surface of a hard disc, which operates at about 90°C, evaporate and be absorbed to damage the hard disc and deteriorate the operation of a peripheral information device. Given the unexpected superior properties associated with the presently claimed grease composition containing a base oil of carbonates having from 13-15 carbon atoms in the alkyl residues, it is respectfully submitted that the presently claimed invention is distinguishable over this reference.

Doner et al and Tanaka et al show the use of molybdenum dithiocarbamate and molybdenum dithiophosphate as enhancing additives in grease compositions. Nothing in these references suggests that anything advantageous would occur by using the carbonate composition of the currently claimed invention in combination with the enhancing additives disclosed in these references. Therefore, the Doner et al and Tanaka et al in combination with Morway et al do not negate the patentability of the presently claimed invention.

A Declaration Under 37 CFR 1.132 is of record in the present application in which grease compositions are prepared containing carbonate compounds having carbon residues outside of the scope of the present claims with a grease composition incorporating a carbonate compound having carbonate residues within the scope of the present invention. Samples A-D all fall within the disclosure of the Morway et al reference in that the alkyl residues of the carbonate compounds contain from 8-16 carbon atoms. These comparative grease compositions are tested against a grease composition of the present invention in which the alkyl residues contain from 13-15 carbon atoms. Everything else is identical in the tested grease compositions.

As shown by Table 2, the grease composition of the present invention which contains 100% of the claimed base oil, exhibited a more than 50% decrease in the generation of outgas than the best of the comparative samples, including Sample D

which contained 20% of carbonate compounds falling within the scope of the present invention. This is clearly unexpected in light of the prior art cited by the Examiner and establishes the patentability of the presently claimed invention thereover.

The presently claimed base oil is known in the industry as Lialcarb SR-1000/R and is a product of Sun Technochemicals Co., Ltd. Analysis of this base oil has been performed and is included herewith for the Examiner's benefit. The present inventors have discovered that a grease composition comprising the claimed carbonic acid ester as a base oil has unexpectedly superior properties when used with ball bearings for a hard disc drive due to the lower evaporation and frictional torque characteristics. The carbonates cited in Morway et al were invented more than 30 years ago and would yield a grease composition comprising a considerable amount of evaporative and volatile substances when carbonates having lower alkyl residues are used as a base oil and would yield a product grease having high viscosity and frictional coefficients when the base oil comprised higher carbon residues. If these grease compositions were used in a hard disc drive, the former grease would easily evaporate and cause an unacceptable friction torque due to high friction coefficients, although lower outgassing may occur as shown in Appendix II enclosed herewith.

The present invention satisfies the requirements of reducing the amount of outgassing generated and lowering the frictional torque by including the claimed base oil with the specified carbon residues. The inventive grease composition for information devices is used by major computer manufacturers and more than 50 million hard disc drives having at least a couple of ball bearings containing the inventive grease have been manufactured over the last three years.

It is respectfully submitted that the presently claimed invention clearly is patentably distinguishable over the prior art cited by the Examiner. The Examiner is respectfully requested to reconsider the present application and to pass it to issue.

Respectfully submitted,


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TFC/smd

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Reg. No. 24 323

Reg. No. 25 072

Reg. No. 22 724

Reg. No. 32 549

Reg. No. 36 589

Reg. No. 31 257

Reg. No. 24 949

Reg. No. 40 694

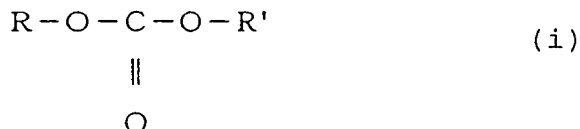
Reg. No. 36 328

Reg. No. 44 621

Encl: Marked-Up Amended Claims 1, 3 and 8
Sealed Certificate showing analysis of
carbonic acid ester depicted in Appendix 1
Appendix 1
Appendix 2
Postal Card

136.0112

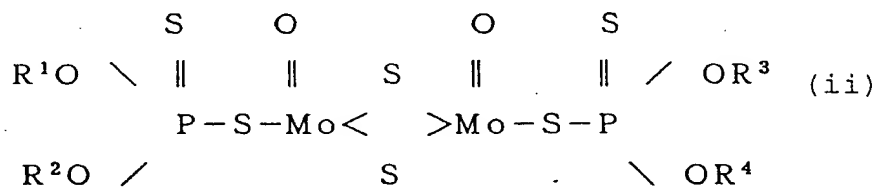
1. (Twice Amended) AIn a grease composition for lubricating a bearing of information devices, the improvement comprises said grease composition comprising:
a carbonate compound of the following general formula (i) serving as a base oil



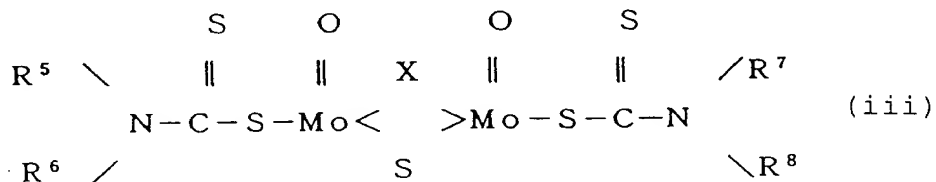
wherein R and R' may be the same or different and independently represent a branched alkyl group having from 13 to 15 carbon atoms;

a lithium soap serving as a thickener; and

at least one organomolybdenum compound selected from the group consisting of a molybdenum dithiophosphate of the general formula (ii)

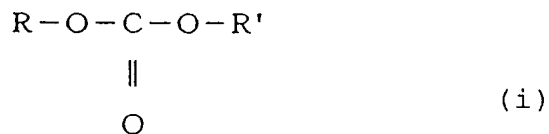


wherein R¹, R², R³ and R⁴ independently represent an alkyl group having from 1 to 24 carbon atoms or an aryl group having from 6 to 30 carbon atoms, and a molybdenum dithiocarbamate of the general formula (iii)

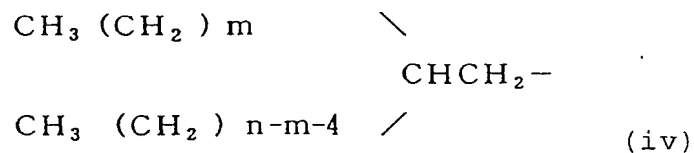


wherein R⁵, R⁶, R⁷ and R⁸ independently represent an alkyl group having from 1 to 24 carbon atoms, and X represents O or S.

3. (Twice Amended) AIn a grease composition for lubricating a bearing of information devices~~which, the improvement~~ comprises said grease composition comprising 70 to 95 parts by weight of a carbonate compound of the general formula (i)



wherein R and R' may be the same or different and independently represent a branched alkyl group of the following general formula (iv)

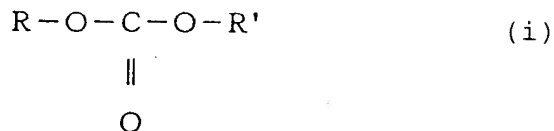


wherein n = 13 to 15 and m = 0 to 6, and 5 to 30 parts by weight of a lithium soap.

8. (~~New~~Amended) AIn a grease composition for lubricating bearings of spindle motors employed in peripheral information devices~~in which, the improvement~~ comprises said grease composition containing:

a carbonate compound of the following general

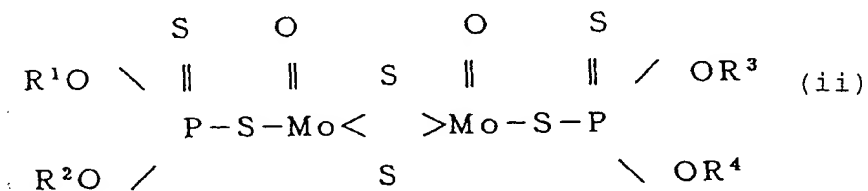
formula (i) serving as a base oil



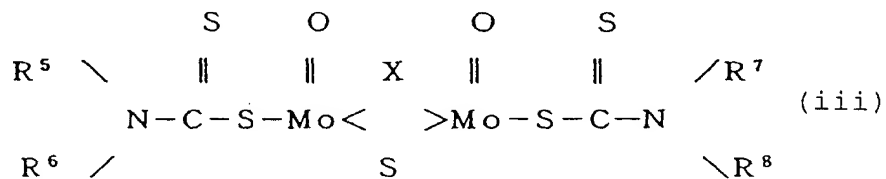
wherein R and R' may be the same or different and independently represent a branched alkyl group having from 13 to 15 carbon atoms;

a lithium soap serving as a thickener; and

at least one organomolybdenum compound selected from the group consisting of a molybdenum dithiophosphate of the general formula (ii)



wherein R¹, R², R³ and R⁴ independently represent an alkyl group having from 1 to 24 carbon atoms or an aryl group having from 6 to 30 carbon atoms, and a molybdenum dithiocarbamate of the general formula (iii)



wherein R⁵, R⁶, R⁷ and R⁸ independently represent an alkyl group having from 1 to 24 carbon atoms, and X represents O or S.

Sun Technochemicals Co., Ltd.

From Ogino, Carbonate Department

TEL: 03-3241-1380

FAX: 03-3241-1759

May 13, Monday, 2002	Total 1 page
To: Mr. Akiyama, Vice-director, Tribology Lab., R&D Center, Minebea Co., Ltd.	
Re: Number of Carbon Atoms in Lialcarb SR-1000/R	

Dear Sirs:

A number of alkyl carbon atoms contained in our product Lialcarb SR-1000/R is as in the following:

Lialcarb SR-1000/R: $R^1\text{-OCO}\text{-}R^2$
 R^1 and R^2 are hydrocarbon of C13 to C15
C13 or less: 2.5 % by mass
C14: 55 to 65 % by mass
C15: 35 to 45 % by mass
not less than C16: 3 % by mass or less

I am sending these data for your information.

Sincerely yours,

Appendix No. 2

Viscous properties of samples used in the Declaration and a grease composition of this invention (Torque determination was carried out at 3,000 rpm by sealing a ball bearing of 22 mm in outer diameter with each grease composition in an amount of 130 mg).

BRG 608MNSD88

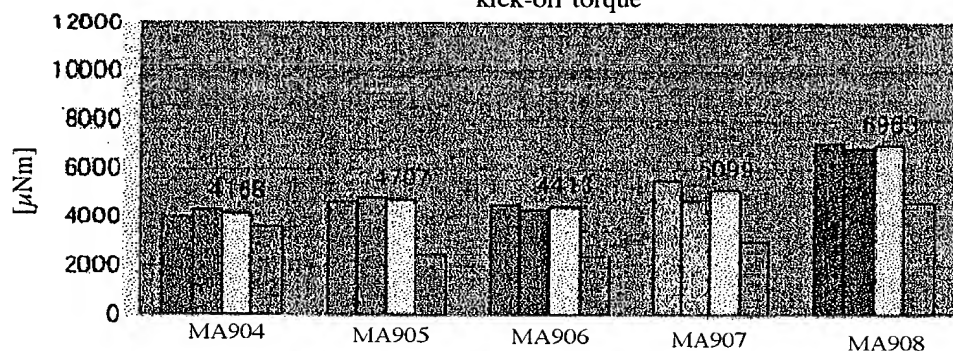
amount of sealing: 130mg

		3000min ⁻¹ kick-off torque (gcm)				
grease		904	905	906	907	908
		20.5	23.5	23	28	36
		22	24.5	22	24	35

		(μNm)				
grease		904	905	906	907	908
		4021	4609	4511	5492	7061
		4315	4805	4315	4707	6865
		4168	4707	4413	5099	6963
		3579	2452	2373	2991	4609

RT X 3000min⁻¹

kick-off torque

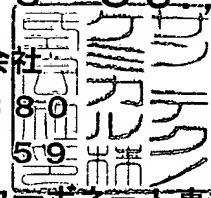


904 Grease composition A described in the Declaration
 905 Grease composition B described in the Declaration
 906 Grease composition C described in the Declaration
 907 Grease composition D described in the Declaration
 908 Grease composition of this invention

Sealed
Certificate (Appendix No.1)
together with its English translation

Sun Technochemicals Co. Ltd.

サン テクノケミカル 株式会社
TEL: 03-3241-1380
FAX: 03-3241-1759



カーボネート事業部 荻野

2002年 5月13日(月)	TOTAL 1 page
宛 先: ミネベア(株) R&Dセンター トライボロジーラボ 秋山次長殿	
件 名: Lialcarb SR-1000/R カーボン数 の件	

拝啓 いろいろお世話になっております。

お尋ねの、弊社製品Lialcarb SR-1000/Rのアルキル基炭素数をご報告いたします。

Lialcarb SR-1000/R : R1-OCOO-R2

R1, R2はC13からC16の炭化水素

C13以下: 2.5%以下

C14 : 55-65%

C15 : 35-45%

C16以上: 3%以下

よろしく願います。

敬具

Appendix No. 1

Sun Technochemicals Co., Ltd.

From Ogino, Carbonate Department

TEL: 03-3241-1380

FAX: 03-3241-1759

May 13, Monday, 2002	Tbtal 1 page
To: Mr. Akiyama, Vice-director, Tribology Lab., R&D Center, Minebea Co., Ltd.	
Re: Number of Carbon Atoms in Lialcarb SR-1000/R	

Dear Sirs:

A number of alkyl carbon atoms contained in our product Lialcarb SR-1000/R is as in the following:

Lialcarb SR-1000/R: $R^1\text{-OCOOR}^2$
 R^1 and R^2 are hydrocarbon of C13 to C15
C13 or less: 2.5 % by mass
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not less than C16: 3 % by mass or less

I am sending these data for your information.

Sincerely yours,